

CLAIMS

What is claimed is:

1. An apparatus comprising:

- 5 a voltage regulator having an output path to couple to a load;
 a first sense point to sense a first feedback signal for the voltage regulator at
a first sense location on the output path; and
 a second sense point to sense a second feedback signal for the voltage
regulator at a second sense location on the output path.

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2. The apparatus of claim 1 further comprising:

- a motherboard to which the voltage regulator is coupled; and
 a socket to couple the load to the motherboard.

15 3. The apparatus of claim 2 further comprising:

- the load;
 wherein the first sense location is on the mother board; and
 wherein the second sense location is on the load.

20 4. The apparatus of claim 1 wherein the load comprises a processor die.

5. The apparatus of claim 1 wherein the voltage regulator comprises:

- a board-sense circuit to receive the first feedback signal; and
 a load-sense circuit to receive the second feedback signal.

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6. The apparatus of claim 5 wherein the board-sense circuit comprises:

- a transient filter to filter signal transients in the first feedback signal.

7. The apparatus of claim 5 wherein the load-sense circuit comprises:

30 a passive filter to capture signal transients in the second feedback signal.

8. The apparatus of claim 5 wherein the load-sense circuit comprises:
a capacitive element; and
a resistive element in parallel with the capacitive element.
- 5 9. The apparatus of claim 5 wherein the load-sense circuit comprises:
an active filter to amplify signal transients in the second feedback signal.
- 10 10. The apparatus of claim 5 wherein the load-sense circuit comprises:
an amplifier; and
a passive filter.
11. The apparatus of claim 10 wherein:
the second sense location comprises a differential pair; and
the amplifier comprises:
15 a first resistive element coupled between a first line of the differential
pair and a first node;
a second resistive element coupled between a ground node and the
first node;
a third resistive element coupled between a second line of the
20 differential pair and a second node;
a differential amplifier having a first input coupled to the first node, a
second input coupled to the second node, and an output coupled to a third node;
and
a fourth resistive element coupled between the second node and the
25 third node, said third node coupled to the passive filter.
12. The apparatus of claim 1 wherein:
the second sense location comprises a differential pair; and
the second sense location comprises differential sense points across the
30 load.

13. The apparatus of claim 12 wherein the second sense location comprises:
a first sense pin for a source voltage at the load; and
a second sense pin for a source ground at the load.

5 14. The apparatus of claim 1 wherein the second sense location comprises a sense pin on the load.

15. An apparatus comprising:

10 a first input circuit to provide a steady-state feedback from a first sense location in an output path, said first sense location being on a motherboard;
a second input circuit to provide a transient response feedback from a second sense location in the output path, said second sense location being on a load that is electrically coupled to the motherboard; and
15 a voltage regulator to regulate a voltage on the output path based at least in part on the steady-state feedback and the transient response feedback.

16. The apparatus of claim 15 wherein the second input circuit comprises a passive, high-pass filter.

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17. The apparatus of claim 15 wherein the second input circuit comprises a capacitor in parallel with a resistor.

18. The apparatus of claim 15 wherein the second input circuit comprises an active,
25 high-pass filter.

19. The apparatus of claim 15 wherein the second sense location comprises a differential pair of sense points on the load, and wherein the second input circuit comprises:

30 a differential amplifier having two inputs to couple with the differential pair of sense points.

20. The apparatus of claim 19 wherein the second input circuit further comprises:

a first input resistor to couple in series with a first one of the differential pair of sense points and a first input of the two inputs of the differential amplifier;

5 a second input resistor to couple in series with a second one of the differential pair of sense points and a second input of the two inputs of the differential amplifier;

a ground resistor to couple a ground to the first input of the differential amplifier; and

10 a feedback resistor to couple an output of the differential amplifier to the second input of the differential amplifier.

21. The apparatus of claim 20 wherein the second input circuit further comprises:

15 a passive, high-frequency filter coupled to the output of the differential amplifier.

22. The apparatus of claim 20 wherein the second input circuit further comprises:

a capacitor and a resistor coupled in parallel, said capacitor and said resistor coupled in series to the output of the differential amplifier.

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23. The apparatus of claim 15 wherein the voltage regulator comprises:

an error amplifier;

a pulse-width modulator; and

a buck regulator.

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24. A method comprises:

sensing a first feedback signal at a first sense location on an output path;

sensing a second feedback signal at a second sense location on the output

30 path; and

regulating a voltage for a load on the output path based at least in part on the first feedback signal and the second feedback signal.

5 25. The method of claim 24 wherein the first sense location is on a motherboard and the second sense location is on the load, said load being coupled to the motherboard by a socket.

10 26. The method of claim 24 wherein sensing the first feedback signal comprises:
filtering signal transients out of the first feedback signal.

27. The method of claim 24 wherein sensing the second feedback signal comprises:
passively filtering the second feedback signal to capture signal transients.

15 28. The method of claim 24 wherein sensing the second feedback signal comprises:
actively filtering the second feedback signal to amplify signal transients.

20 29. A system comprising:
a motherboard;
a processor coupled to the motherboard; and
a voltage regulation to provide a voltage signal for the processor, said voltage regulation circuit comprising
25 a first input circuit to provide a steady-state feedback from a first sense location in a voltage path for the voltage signal, said first sense location being on the motherboard;
a second input circuit to provide a transient response feedback from a second sense location in the voltage path, said second sense location being on the
30 processor; and

a voltage regulator circuit to regulate the voltage signal based at least in part on the steady-state feedback and the transient response feedback.

5 30. The system of claim 29 wherein the second input circuit comprises a passive, high-pass filter.

31. The system of claim 29 wherein the second input circuit comprises a capacitor in parallel with a resistor.

10 32. The system of claim 29 wherein the second input circuit comprises an active, high-pass filter.

15 33. The system of claim 29 wherein the second sense location comprises a differential pair of sense points on the load, and wherein the second input circuit comprises:

a differential amplifier having two inputs to couple with the differential pair of sense points.